# The effect of viewing angle on EUV spectra of laser produced Gadolinium plasmas


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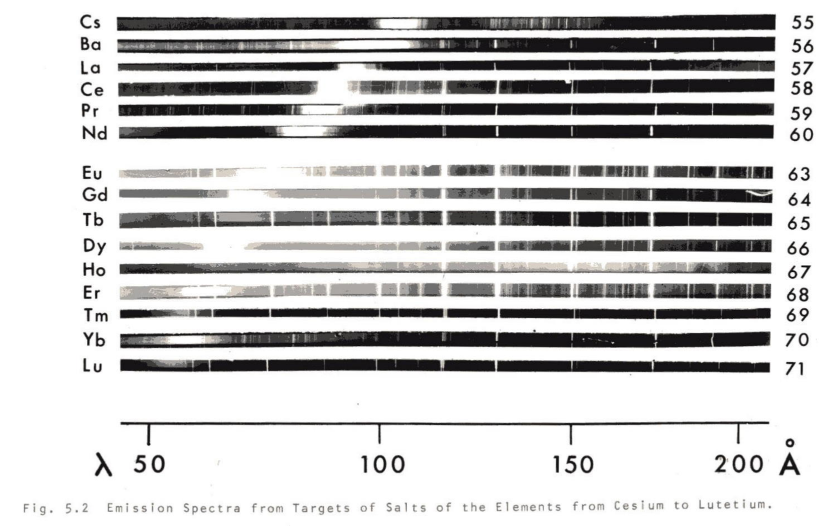


**Figure 1:** *UTA emission from the elements of Cesium to Lutetium [1]*

## 1.Introduction

•Gd LPPs coupled with La/$B_4$C MLM to be used as a source for BEUVL at 6.xnm

•Spectral emission from laser produced plasmas varies as a function of viewing angle[2]

•This effect must be quantified for the measurement of conversion effieciency to be comparable in different experiments[3]

## 2.Experimental Setup

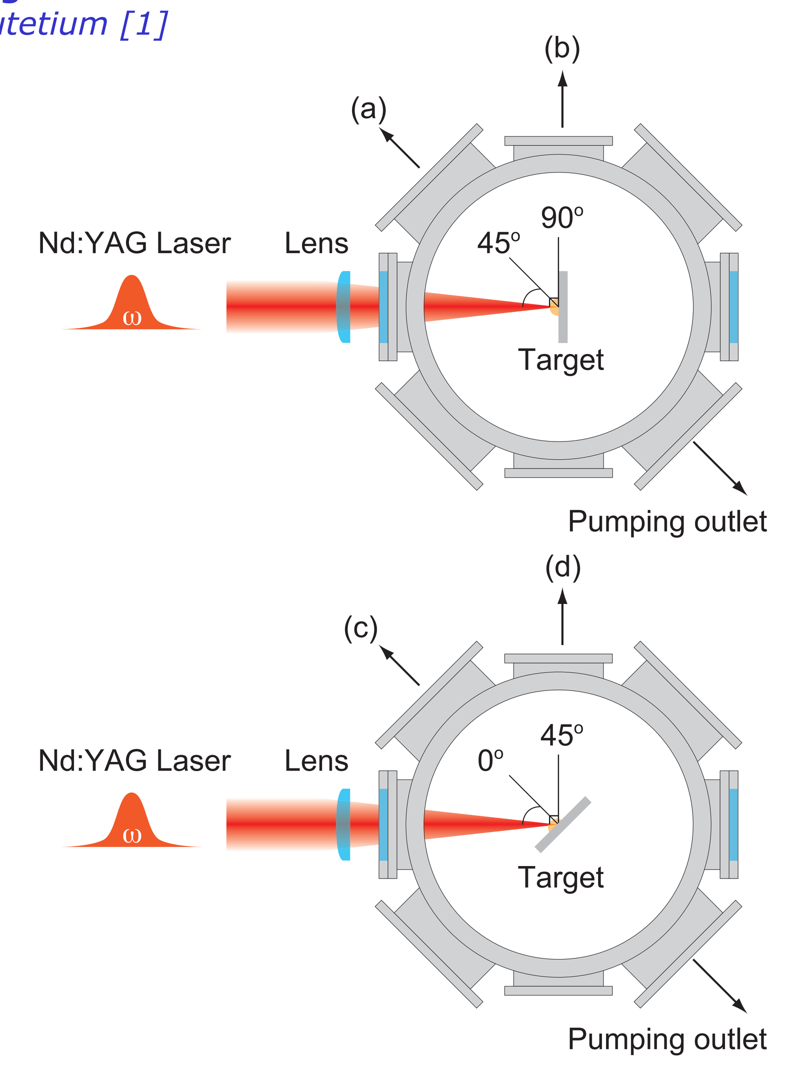


**Figure 2:** *Schematic of two target geomitries used and the different detection angles*

•A 150 ps and 10 ns 1064 nm, Nd:YAG laser pulse with energy of 160mJ and 300mJ irradiated the target.

• A range of power densities was achieved by varying the incoming laser energy.

• Emission spectra was recorded for 4 different experiemntal setups using a flat field grazing incidence spectrometer with a 1200/mm variable line spaced grating

•The time-integrated spectra were detected by a thermoelectrically cooled back-illuminated x-ray charge coupled device (CCD) camera

## 3. Emission Spectra

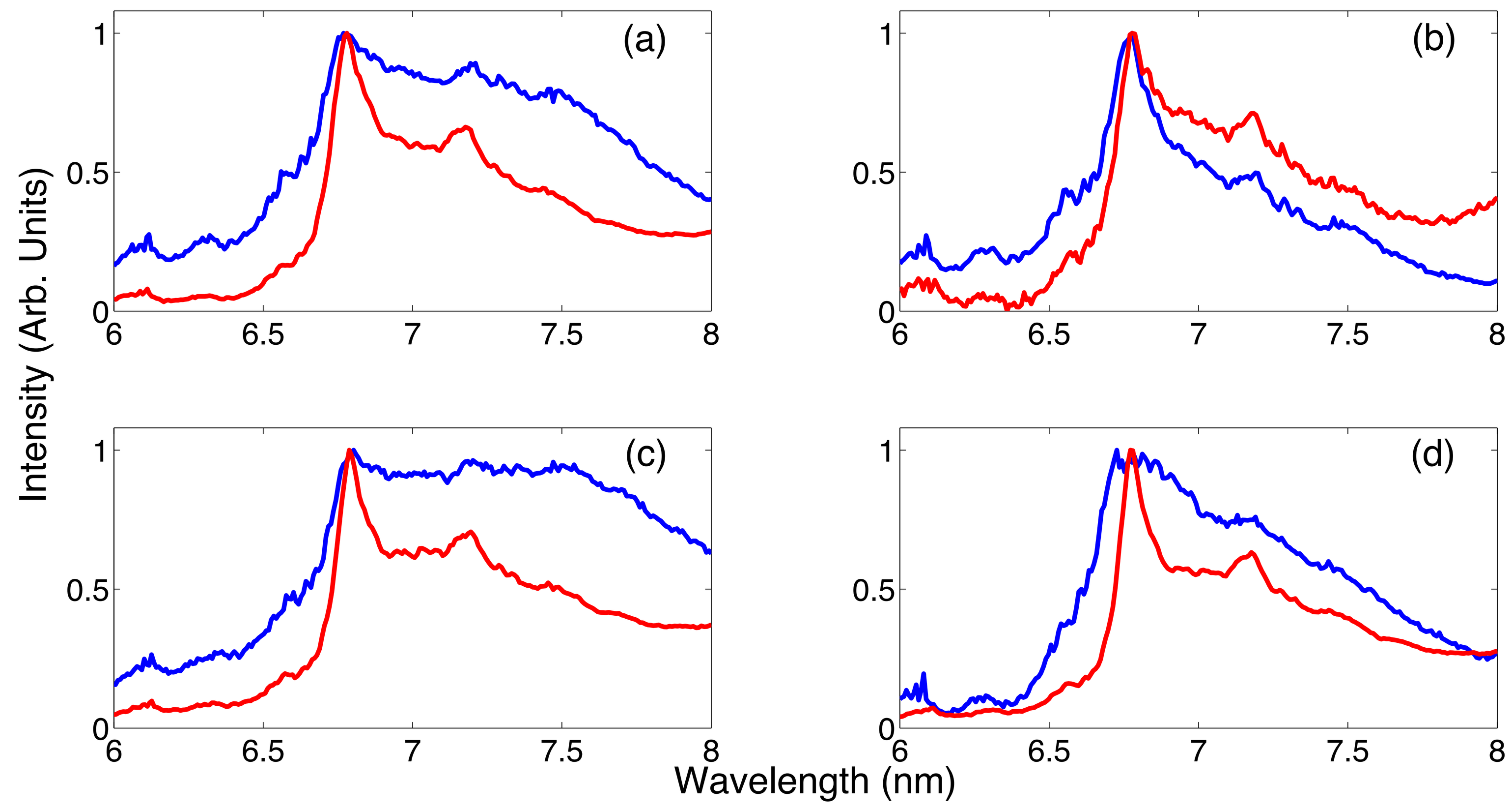


**Figure 3:** *Emission spectra from the 10ns (blue) and the 150ps (red) LPPs for the four different target geometries, shown in figure 2*

•Emission spectra is shown to vary greatly as a function of viewing angle when the 7ns laser is used due to absorption by low ion stages in the perihphery of the plasma[4,5].

•Emission from 150ps LPP is more isotropic due to a higher rate of plume expansion. The plasmas is also optically thinner

## 4. Low Density Target

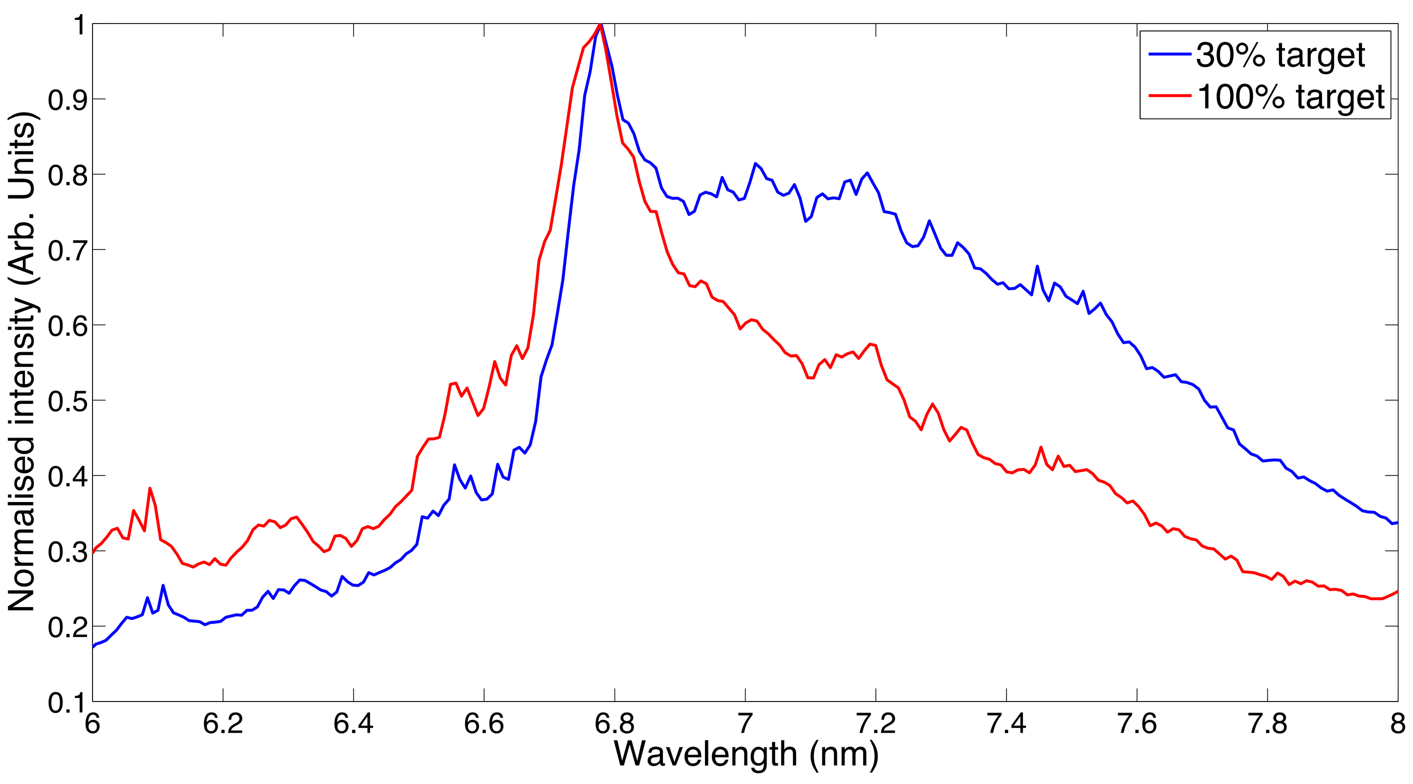


**Figure 4:** *Emission spetctra from 30% low density target compared to 100% for target geometry (b)*

•A low density foam target was irradiated with the 10ns laser

•Emission spectra from this low density target did not show the same absorption effects due to a lower density plasma

## 5. Comparison to CR model

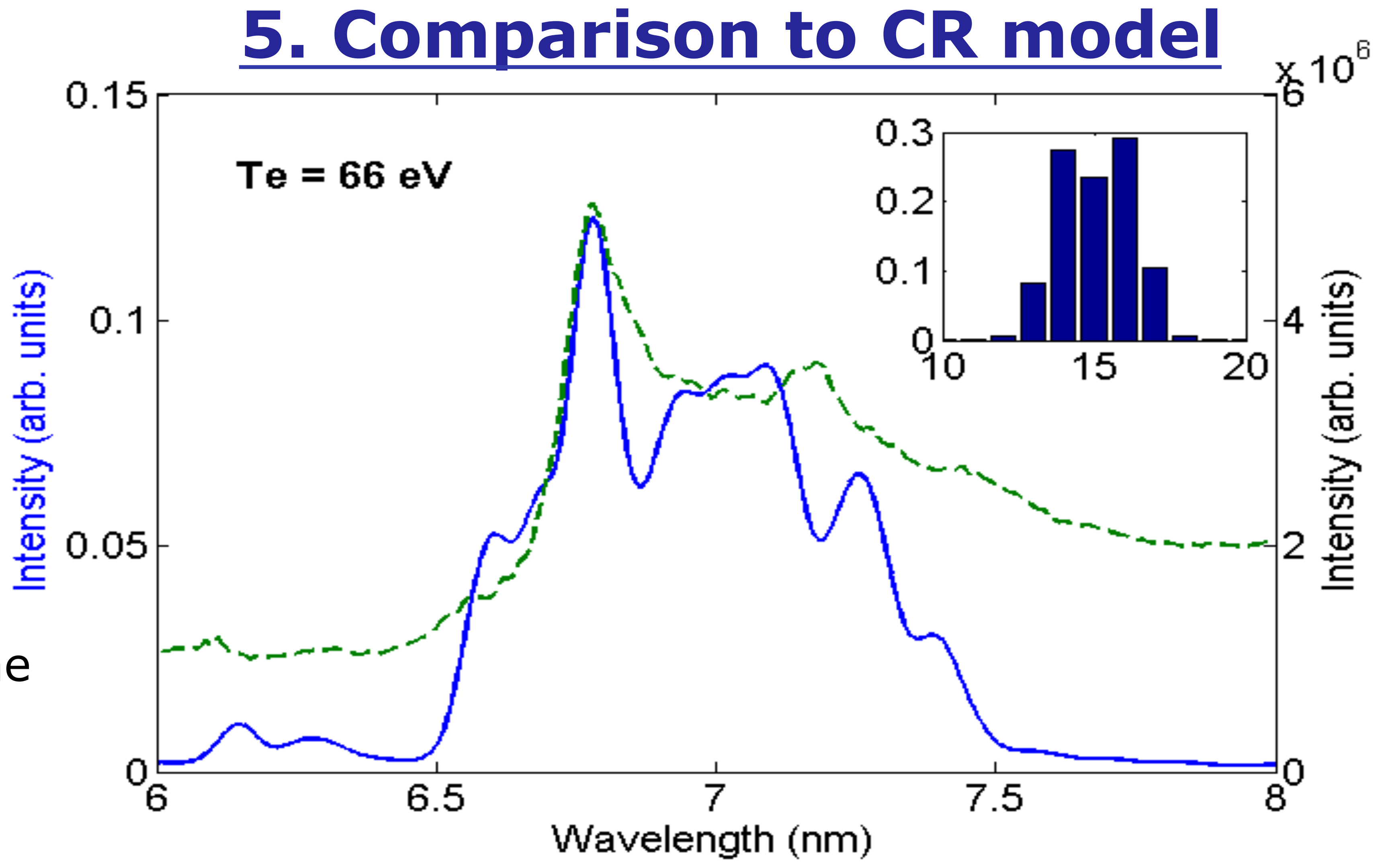


**Figure 5:** *Theoretical spectra of best fit to experimental spectra produced by the 150ps Laser, the inset shows the ion distribution at this temperature of best fit*

•Cowan code[6] calculations weigthed with a collisional radiative model[7] gives theoretical spectra at a given electron temperature

•Spectra from the 150 ps LPP was found to have the same plasma temperature for all target geomitries

•Spectra from 10 ns LPP were unable to be fitted with a theoretical spectra

•2D expansion and absorption effects must be taken into account

## 6.Future Work

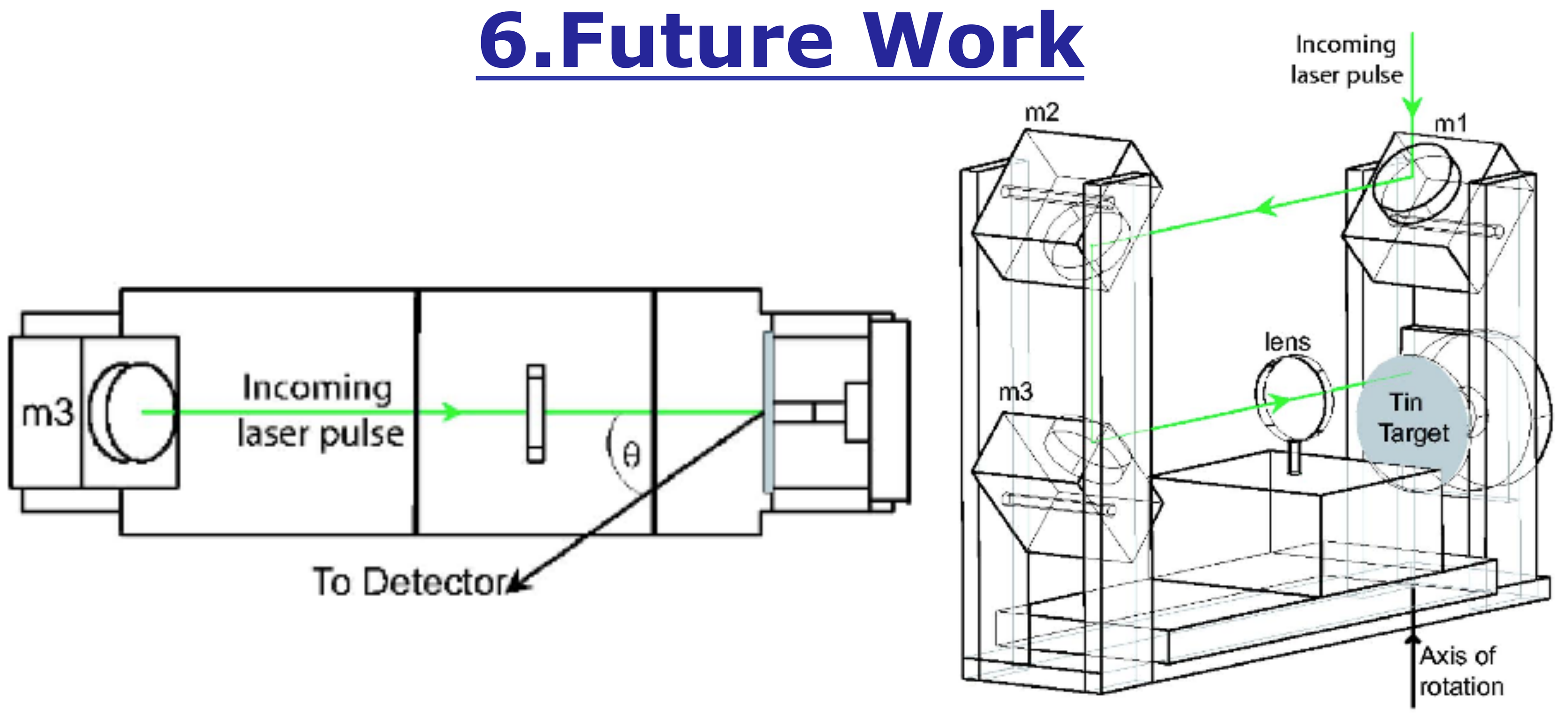


**Figure 6:** *Schematic of an internal optical system to be used in future to give higher angular resolution [8]*

•Higher angular resolution will be achieved by using an optical setup described by Morris[8], shown in figure 6

•Imaging of plasma expansion using 100ps gate camera

•Nomarski interferometry to quantify 2 dimensional density profile of expanding plasma plume

## 7.References


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